

CLAIMS

1. A primary alkaline battery, comprising:
a cathode comprising
5 manganese dioxide and
carbon particles comprising expanded graphite particles and non-expanded
graphite particles, the expanded graphite particles having a kerosene absorption greater than
about 2.7 milliliters per gram;
an anode;
10 a separator; and
an alkaline electrolyte.
2. The battery of claim 1, wherein the expanded graphite particles have a
kerosene absorption greater than about 3.0 milliliters per gram.
3. The battery of claim 1, wherein the expanded graphite particles have a
kerosene absorption greater than about 3.5 milliliters per gram.
4. The battery of claim 1, wherein the expanded graphite particles have a
20 kerosene absorption greater than about 4.0 milliliters per gram.
5. The battery of claim 1, wherein the expanded graphite particles have a
kerosene absorption greater than about 4.5 milliliters per gram.
- 25 6. The battery of claim 1, wherein the expanded graphite particles have a
kerosene absorption greater than about 5.0 milliliters per gram.
7. The battery of claim 1, wherein the cathode comprises between about 75%
and 25% of expanded graphite particles by weight and between about 25% and 75% of non-
30 expanded graphite particles by weight.

8. The battery of claim 1, wherein the cathode comprises between about 60% and 40% of expanded graphite particles by weight and between about 40% and 60% of non-expanded graphite particles by weight.

5 9. The battery of claim 1, wherein the non-expanded graphite particles have an average particle size of less than about 40 microns.

10 10. A primary alkaline battery, comprising:
a cathode comprising
manganese dioxide and
carbon particles comprising expanded graphite particles and non-expanded
graphite particles, the expanded graphite particles having a BET surface area greater than
about 5 m²/g;
an anode;
15 a separator; and
an alkaline electrolyte.

20 11. The battery of claim 10, wherein the expanded graphite particles have a BET surface area greater than about 10 m²/g.

12. The battery of claim 10, wherein the expanded graphite particles have a BET surface area greater than about 15 m²/g.

25 13. The battery of claim 10, wherein the expanded graphite particles have a BET surface area greater than about 20 m²/g.

30 14. The battery of claim 10, wherein the cathode comprises between about 75% and 25% of expanded graphite particles by weight and between about 25% and 75% of non-expanded graphite particles by weight.

15. The battery of claim 10, wherein the cathode comprises between about 60% and 40% of expanded graphite particles by weight and between about 40% and 60% of non-expanded graphite particles by weight.

5 16. The battery of claim 10, wherein the non-expanded graphite particles have an average particle size of less than about 40 microns.

10 17. A primary alkaline battery, comprising:
a cathode comprising
manganese dioxide and
carbon particles comprising expanded graphite particles and non-expanded
graphite particles, the expanded graphite particles having a Scott apparent density less than
about 0.08 g/mL;
an anode;
15 a separator; and
an alkaline electrolyte.

20 18. The battery of claim 17, wherein the expanded graphite particles have a Scott apparent density less than about 0.07 g/mL.

25 19. The battery of claim 17, wherein the cathode comprises between about 75% and 25% of expanded graphite particles by weight and between about 25% and 75% of non-expanded graphite particles by weight.

30 20. The battery of claim 17, wherein the cathode comprises between about 60% and 40% of expanded graphite particles by weight and between about 40% and 60% of non-expanded graphite particles by weight.

21. The battery of claim 17, wherein the non-expanded graphite particles have an average particle size of less than about 40 microns.

22. A primary alkaline battery, comprising:
a cathode comprising
manganese dioxide and
carbon particles comprising expanded graphite particles and non-expanded
5 graphite particles, the expanded graphite particles having a D_{50} particle size greater than
about 35 microns;
an anode;
a separator; and
an alkaline electrolyte.

23. The battery of claim 22, wherein the expanded graphite particles have a D_{50}
particle size between about 35 and about 100 microns.

24. The battery of claim 22, wherein the expanded graphite particles have a D_{50}
15 particle size between about 40 and about 50 microns.

25. The battery of claim 22, wherein the cathode comprises between about 75%
and 25% of expanded graphite particles by weight and between about 25% and 75% of non-
expanded graphite particles by weight.

26. The battery of claim 22, wherein the cathode comprises between about 60%
and 40% of expanded graphite particles by weight and between about 40% and 60% of non-
expanded graphite particles by weight.

27. The battery of claim 22, wherein the non-expanded graphite particles have an
25 average particle size of less than about 40 microns.

28. A primary alkaline battery, comprising:
a cathode comprising
30 manganese dioxide and

expanded graphite particles having a kerosene absorption greater than about 4.4 milliliters per gram;

an anode;

a separator; and

an alkaline electrolyte.

29. The battery of claim 28, wherein the graphite particles have a kerosene absorption between about 5 and about 6 milliliters per gram.

30. The battery of claim 28, wherein the graphite particles have a kerosene absorption between about 5.2 and about 5.6 milliliters per gram.

31. The battery of claim 28, wherein the graphite particles have a kerosene absorption about 5.4 milliliters per gram.

32. The battery of claim 28, wherein the cathode comprises between about 2% and about 10% of expanded graphite particles by weight.

33. The battery of claim 28, wherein the cathode comprises between about 3% and about 6% of expanded graphite particles by weight.

34. The battery of claim 28, wherein the cathode comprises between about 80% and about 95% of manganese dioxide by weight.

35. The battery of claim 28, wherein the cathode comprises between about 85% and about 90% of manganese dioxide by weight.

36. The battery of claim 28, wherein the cathode further comprises non-expanded graphite particles.

37. The battery of claim 36, wherein the cathode comprises between about 75% and 25% of expanded graphite particles by weight and between about 25% and 75% of non-expanded graphite particles by weight.

5 38. The battery of claim 36, wherein the cathode comprises between about 60% and 40% of expanded graphite particles by weight and between about 40% and 60% of non-expanded graphite particles by weight.

10 39. A primary alkaline battery, comprising:
a cathode comprising
manganese dioxide and
expanded graphite particles having a total pore volume greater than about 0.1 milliliter per gram;
an anode;
15 a separator; and
an alkaline electrolyte.

20 40. The battery of claim 39, wherein the expanded graphite particles have a total pore volume greater than about 0.15 milliliter per gram.

25 41. The battery of claim 39, wherein the expanded graphite particles have a total pore volume greater than about 0.2 milliliter per gram.

30 42. The battery of claim 39, wherein the cathode comprises between about 2% and about 10% of expanded graphite particles by weight.

43. The battery of claim 39, wherein the cathode comprises between about 3% and about 6% of expanded graphite particles by weight.

30 44. The battery of claim 39, wherein the cathode comprises between about 80% and about 95% of manganese dioxide by weight.

45. The battery of claim 39, wherein the cathode comprises between about 85% and about 90% of manganese dioxide by weight.

5 46. The battery of claim 39, wherein the cathode further comprises non-expanded graphite particles.

10 47. The battery of claim 46, wherein the cathode comprises between about 75% and 25% of expanded graphite particles by weight and between about 25% and 75% of non-expanded graphite particles by weight.

15 48. The battery of claim 46, wherein the cathode comprises between about 60% and 40% of expanded graphite particles by weight and between about 40% and 60% of non-expanded graphite particles by weight.

20 49. The battery of claim 46, wherein the non-expanded graphite particles have an average particle size of less than about 40 microns.

FOI 2014-071101